PART 1

PROJECT REQUIREMENTS

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PART 1
PROJECT REQUIREMENTS

1.1 Project Background:

Bengaluru, the capital city of Karnataka State is today ranked the third largest city in India and is one of the fastest growing metropolitan cities. The City is branded as "Silicon Valley of India" for spearheading the growth of information and technology along with BT based industries. In addition, the city is a Centre for education, sophisticated high-tech health care and many MNC industries that attract people from all over India to migrate in search of jobs. Bengaluru has witnessed 66.52% population growth during the last decade between 2001 and 2011. The 2011 census population for Bengaluru city was about 8.5 million.

The Bangalore Development Authority (BDA) which was constituted in the year 1976 is the planning authority for the Bengaluru Metropolitan area. As per the revised Comprehensive Development Plan (CDP) (which is also called Revised Master Plan-2031) for 2031 prepared by BDA, Bengaluru has an urban area of 1219.5 sq. km Area under Local Planning Area of BDA as per RMP- 2015, (excluding the area under BMICAPA which is 87.5 Sq. Km). BMA area as per RMP 2015 is 1307 Sq. Km.

In January 2007, the Karnataka Govt. issued a notification to merge 100 wards of the erstwhile Bangalore Mahanagara Palike with seven city Municipal Councils (CMC's), one Town Municipal Council (TMC) and 110 villages around the city to form a single administrative area. The process was completed by April 2007 and the body was renamed as Bruhat Bangalore Mahanagara Palike – BBMP- (Greater Bengaluru Municipal Corporation) covering an area of 800 sq. km. The population of BBMP (the year 2019) is about 10.17 Million. The BBMP population is expected to increase to 14.29 million by the year 2031.

Creation of basic facilities like water supply and sewage treatment in addition to other infrastructures to meet the requirement of increased population is equally important. Bangalore Water Supply and Sewerage Board is the agency responsible for providing portable water supply to BBMP area and conveying the waste water and treating the same for safe disposal.

Project Requirements:

After studying pros and cons of different types of treatment plants it is decided to go for continuous flow type Activated Sludge Process (ASP) for treatment of sewage at Byramanagala.

The Activated Sludge Process (ASP) is a widely used biological wastewater treatment method. The Activated Sludge Process is a reliable and efficient method for treating wastewater, making it suitable for various industrial, municipal, and domestic applications.

Key Components:

1. Aeration Tank: Where wastewater is mixed with activated sludge.
2. Settling Tank (Clarifier): Where solids settle, separating from treated water.
3. Return Activated Sludge (RAS) System: Returns settled sludge to the aeration tank.

Process Steps:

1. Pre-treatment: Physical treatment (screening, grit removal).
2. Primary Treatment: Removal of suspended solids and organic matter.

3. Aeration: Mixing wastewater with activated sludge, oxygen, and nutrients.
4. Biological Degradation: Microorganisms break down organic matter.
5. Settling: Solids separation in clarifier.
6. Tertiary: Disc Filter and Ultrafiltration
7. Disinfection: Treated water disinfection.
8. Mechanical Sludge Thickening
9. Anaerobic Sludge Digester (Mesophilic)
10. Power Generation using Biogas Generated
11. Dewatering Centrifuge (Produced Class B Sludge)

Salient Features:

1. Biological treatment: Utilizes microorganisms to break down organic pollutants, process configuration arranged to achieve biological nutrient removal
2. Aeration: Provides oxygen for microbial growth.
3. Sludge recycling: RAS system maintains optimal sludge levels.
4. Flexibility: Can treat various wastewater types and flow rates.
5. High efficiency: Effective removal of BOD, COD, and nutrients.
6. Low capital costs: Compared to other biological treatment methods.
7. Primary treatment and anaerobic digestion for onsite biogas and power generation

In respect of standards specific for treated sewage discharge into surface waters, the values of BOD not exceeding 20 mg/L and SS not exceeding 30 mg/L have been of historical origin. However, the guidelines for treated sewage if discharged into surface waters used as a source of drinking water is (1) BOD not exceeding 10 mg/L, (2) SS not exceeding 10 mg/L, (3) Total Nitrogen as N not exceeding 10 mg/L, (4) Total Phosphorous as TP not exceeding 1 mg/L and (5) Faecal coliforms not exceeding 230 MPN / 100 ml. However, this is further revised by State / Central Pollution Control Boards to cover NGT requirements as specified in the following Table:

Characteristics	**Unit**	**Design quality of raw sewage**	**Design quality of treated sewage after treatment**
BOD5	mg/l	280	=<10
TSS	mg/l	290	=<10
TKN	mg/l	65	=<5
TN	mg/l	65	=<10
NH_4-N	mg/l	40	=<5
COD	mg/l	590	=<50
TP	mg/l	6.5	=<1
Fecal Coliform	MPN/100ml	1x10^6	=<100

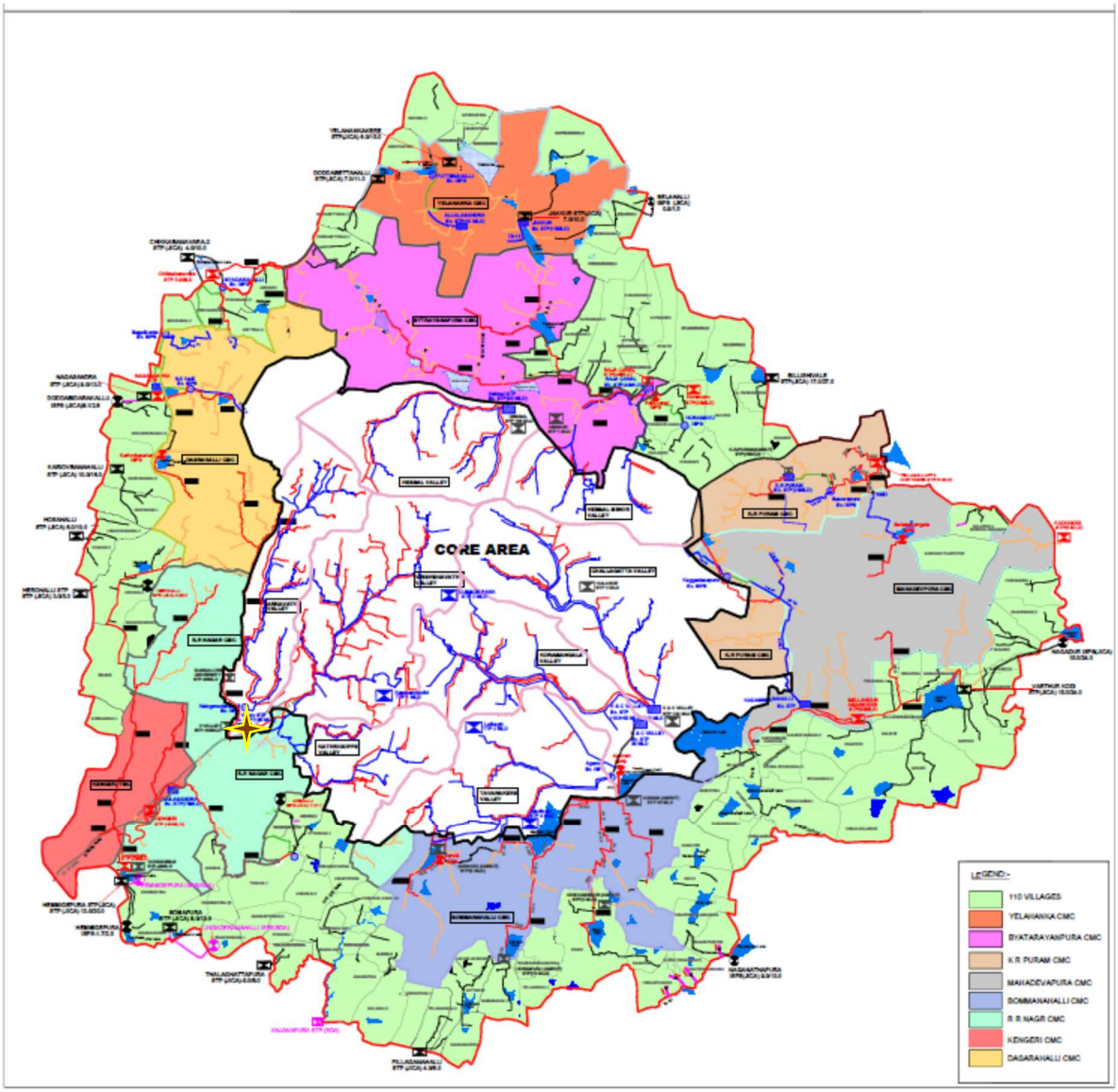
Residual free chlorine	mg/l	Nil	=<1 (should be 0.2 – 1 mg/l)
pH		6.5-8	6-8

1.2 General Description of Project Area

The Byramangala STP site is located on upstream of Byramangala Reservoir, adjoining to Vrishabavathi River. The geographical location of Byramangala STP is 12° 46' 37" N and 77° 25'34" E. The satellite image of proposed site for new STP at Byramangala adjacent to Virshabhavathi River is shown below;

Figure 1.3- Aerial View of Proposed STP Plant at Byramangala

The proposed site for the new Sewage Treatment Plant (STP) at Byramangala is located near the Byramangala Reservoir. A total area of Approximate 15 Acres is available for the establishment of the new STP. At the Byramangala site, if any existing structures are found that require removal to facilitate the construction of the new STP, the Contractor shall be solely responsible for the demolition, removal, and proper disposal of such structures. In addition, vegetation, excess soil,any rock and debris presently dumped within the open area shall be cleared and disposed of appropriately prior to commencement of construction activities. The land at the site generally slopes from east to west towards the Vrishabhavathi River.



Indicates the Location of Project Area

Figure 1.1 Bangalore city comprehensive Sewerage system map with Project area and the location map of Vrishabhavathy Valley

1.3 Description of the work

After studying pros and cons of different types of treatment plants it is decided to go for continuous flow type Activated Sludge Process (ASP) with power generation for treatment of sewage at Byramangala. Based on the sewage quality parameters, circular type Primary and Secondary clarifiers are proposed at Byramangala STP.

The proposed 100 MLD Sewage Treatment Plant at Byramangala shall comprise the following components:

Process Selected:

a. Inlet works
b. Primary settling

c. 4-stage Bardenpho for biological nitrogen removal
d. Alum addition for chemical phosphorous removal
e. Anaerobic digestion of primary and secondary sludge for biogas and on-site power generation

Key Components of the proposed STP:

(a) Components and unit processes as described in Volume 2, Section 7, Part 5 (Process Requirements) of these tender documents
(b) All functional buildings, structures, equipment, and any and all other items, accessories, and ancillaries required for proper functioning and operation of the above components and unit processes.
(c) Civil and Building Works for
- Structures for afore mentioned processes
- Pipeline Systems and Channels
- Roadways, Curbs, Pavements, Parking Spaces, and associated drainage
- Pumping Mains
(d) Complete Electrical Equipment and Systems
(e) Complete Mechanical Equipment and Systems
(f) Complete Instrumentation, Control, and Automation Equipment and Systems
(g) Civil, Mechanical, Electrical, and Instrumentation, Control, and Automation Erection, Installation, Testing, and Commissioning Services

1.4 Scope of Work

The Scope of Work under this contract includes but is not limited to the following in relation to the design, construction, and operation of the Works:

1. Site Topographic Survey and Geotechnical Investigations, water sample analysis and other requirements as stipulated in the specification elsewhere; Setting out the works;
2. Mobilization of key management & design staff as per clause 1.12 of this specification. The contractor shall submit resumes of the personnel for review and approval of the engineer. The contractor shall ensure that the key staff indicated in the clause 1.12 is available during the execution of the project and shall be present during review meetings to be conducted by the engineer.
3. Site Clearing, Excavation, Leveling, Grading and Backfilling Activities;
4. Basic engineering package (BEP), Process, Hydraulic Design and Mass Balance, etc;
5. Preparation of GA Drawings, Site Layout, Unit Process/Equipment/Facility/Building layouts, Hydraulic Profile, Process Flow Diagram,
6. Process and Instrumentation Diagram (P&ID)
7. HAZOP studies (Note: The contractor shall carry out Hazop study from a authorized, certified third party HAZOP agency. The credentials of the agency shall be submitted for review and approval. The HAZOP study shall be conducted before the final approval of P&ID and control philosophy. The findings of the HAZOP study shall be incorporated in the P&ID and control philosophy, cause & effect, interlock diagrams and all other related design and drawings.

8. Detailed Sizing, Design, and Engineering, of all treatment units, buildings, structures, and equipment (including all civil, mechanical, electrical, architectural, instrumentation, control, automation, and SCADA components)
9. Design and construction of tertiary treatment units comprising of disk filter and UF systems and as required as per bid requirements
10. Design and Construction of Ultrafiltration System (The Contractor shall design and construct the civil works for a 100 MLD capacity Ultrafiltration (UF) system, and install a 25 MLD modular Ultrafiltration (UF) system during the initial phase. Provision shall be made for installation of the balance 75 MLD in modular units of 25 MLD each at later stages) as per bid requirement.
11. Design and Construction of all Civil Structures and Building Works
12. Design, Construction and Commissioning of Bypass Lines
13. Submission of Detailed Engineering Designs, Drawings, Process Calculations, Data Sheets as per bid requirements
14. Procurement, Supply and Installation, Erection of all Mechanical, Electrical, Instrumentation, control & SCADA Equipment for complete auto operation of the treatment plant.
15. Execution of all Civil, Mechanical, Electrical, Instrumentation, SCADA Works at Site including Construction, Erection, Testing
16. Construction of Internal Plant Roads, Curbs, Pavements, Parking Spaces, Compound Wall, Plant Water Supply and Sewage Disposal and Storm Water Drains
17. Dismantling of existing units wherever necessary for accommodating the proposed system.
18. No part of the work will be in Employers scope, all the works shall be in scope of the Bidder.
19. Design and Construction of Terminal Sewage Pumping Station (TSPS).
20. Plant water system and bore well water system including Yield study for Bore wells shall be carried out and submitted to Employer's review and approval.
21. Design and Construction of Plant drain system.
22. Design and construction of Class B sludge treatment system with Biogas-Based Power Generation.
23. Transportation and safe disposal of sludge. The location of disposal point shall be identified jointly during O&M.
24. Plantation and Landscaping work: Area for landscaping will equal to total area of project site minus area for the treatment plant units minus the area required for roads, sidewalks and drains.
25. Receiving Raw Inlet Sewage at site and discharge of Plant Effluent to nearby water body or reuse as specified in Employer's requirements
26. Getting required consent and clearances from State and Central (KSPCB, PESO) Authority to set up and operate the proposed plant.
27. Getting Renewable Energy Certificate from relevant authorities on behalf of Employer for proposed plant. All necessary statutory approval required from KERC shall be obtained by the Contractor.
28. Design and Construction of Compound wall proposed plant as per specification.
29. Design, construction, and commissioning of pipelines, conduits for the disposal of treated plant effluent to nearby water body.

30. Landscaping with Sprinkler system as required to the satisfaction of Employer.
31. Plant Testing, Commissioning, Stabilization, Demonstration of Performance Guarantee. This item shall include proper maintenance according to manufacturers' instructions of entire plant and its components during any inactive period that may be required if influent wastewater is not available at the time of STP completion.
32. Submission of Operation and Maintenance Manuals
33. Seven (7) Years Operation and Maintenance of constructed facilities from the date of completion of the Works and successful passing test on completion as per the Conditions of Contract given in Volume-1 of tender document.
34. Providing Training Services to Employer's Personnel including O&M staff.
35. Preparation and Submission of As-Built drawings for all Civil, Mechanical, Electrical, Instrumentation, SCADA Works
36. Design, construction, installation, testing, commissioning, and training for any and all other equipment, systems, components, and/or services that might be necessary for a complete, fully functional facility in compliance with all requirements of these tender documents.
37. Handing Over activities on completion of project
38. Providing STP Physical Model of constructed facilities.
39. Providing complete plant construction, execution photos and videos to be used in the stationary displays (audio/video displays systems).
40. Complete plantation and landscaping works to give pleasant environment of buildup area.
41. Real time online multiparameter monitoring systems at Inlet & outlet of STP & auto sampler's and laboratory equipment's, LIMS complete.
42. PLC based SCADA system for fully automatic & safe operation of STP & TSPS.
43. Wireless Communication System for remote monitoring of complete STP and TSPS from Central SCADA Station at Shimsha Bhavan as well as wireless communication between STP & TSPS control system.
44. Auxiliary systems like CCTV monitoring of STP and TSPS.
45. Providing Solar power panels for generating renewable energy from solar power on top of all buildings (Minimum of 70% of the roof area shall comprise of Solar Panels, necessary EI&M equipment's for generation and storage of renewable energy)
46. Rain water Harvesting by connecting all roofs of all buildings with pipe lines and draining them to a Water tank for storage and use as per detailed specifications
47. Handing Over activities on completion of project

Notes:

1. *Contractor to submit Unit Process/ Equipment/ Facility/ Building wise Construction Approach and Methodology, prior to start of each/ any type of constructional activity at site.*
2. *It shall be mandatory for Contractor to take prior approval on EMP and EMoP document based on the requirements as specified in Part 18 of the Tender Document.*

1.5 Additional Scope for Civil Works

The scope of work for STP shall include all civil works as per process requirements, including other facilities as listed below.

General points to be noted and implemented for STP

1. Plant internal roads shall be at least 6m wide with two side RCC (RCC precast/ insitu) drain for STP and 3m wide road for PS with 5m wide at the entrance of PS.
2. Parking sheds in Steel Structure with RCC foundation pedestal and corrugated MS sheets for roof of not less than 100 Sqm for STP shall be provided.
3. The undulated ground shall be properly graded up to the site FGL for the STPs and other units. Building plinth shall be minimum 450 mm above average finished ground level around building or high flood level whichever is more.
4. HFL provided in this document is for the guidance only. Further the same shall be ascertained during execution by confirmatory Survey and Geotechnical report, as per site requirement and shall get approved from the Engineer in charge.
5. The information provided in this document is only the minimum requirements at the site. The contractor shall visit the site and Bid as per the actual site requirements. No additional claim or variation shall be allowed in case, if there is any change in minimum requirement.
6. The HFL, FGL and EGL provided are to be field verified by the Bidders.
7. 450mm thick Stone soling shall be provided for buildings and structure foundations below PCC for structures coming under water logged areas to improve the strength of the soil.
8. All trees, vegetation shall be removed after obtaining necessary permissions from the concerned authority and instructions of Engineer in Charge.

1.6 Treated Effluent and Sludge Characteristics

The treated effluent and sludge characteristic for the STP shall comply with the following standards given in the Table below:

Parameters	Unit	Value
STP Treated Effluent Quality Requirements (at outlet of Chlorine Contact Tank)		
pH - Instantaneous range		6.5 - 8.0
BOD_5 at 20^0C- Maximum monthly average	mg/L	≤ 10
COD - Maximum monthly average	mg/L	≤ 50
TSS - Maximum monthly average	mg/L	≤ 10
Total Nitrogen - Maximum monthly average	mg/L	≤ 10
Alkalinity - Minimum instantaneous	mg/L as $CaCO_3$	≥ 70
Total Phosphorus - Maximum monthly average	mg/L	≤ 1
Residual Chlorine - Instantaneous	mg/L	>0.2 to <0.5 at CCT Outlet
Faecal Coli-form - Maximum monthly average	MPN/100 mL	≤ 100
TTP Treated Water Quality Requirements (at Outlet of Ultrafiltration)		
pH		6.5-8.0
Turbidity (NTU Scale), Max. instantaneous	NTU	<2

Parameters	Unit	Value
Total Suspended Solids-TSS	mg/L	<2
Biological Oxygen Demand -BOD	mg/L	<2
Residual chlorine, instantaneous	mg/L	0.5 to 1
Fecal Coliform	MPN/100 mL	Nil (non detect)
Sludge for Disposal		
Maximum VSS/TSS ratio	%	70
Solid Concentration in Dewatered Sludge	%	20
Grit for Disposal		
Organic Content in Grit	%	≤ 5

1.7 Site Conditions

The Plant shall be designed and constructed taking into account the following:

Annual Average Ambient Temperature	:	27º C (Minimum 15ºC - Maximum 45º C)
Relative Humidity (maximum)	:	75 %
Site Conditions	:	Tropical Average elevation above MSL: RL 790 m at Byramanagala STP site Average elevation above MSL: RL 782.12 m at TTP site

The plant shall be designed to suit the ambient temperature mentioned above with the Contractor making due allowance in his designs for the increased temperatures experienced by Plant exposed to direct sunlight.

1.8 Minimum Design Life

The Plant components shall be designed and constructed to provide the minimum service life listed below for each component.

Reinforced Concrete Structures	:	60Years
Buried Piping	:	60 Years
Other Civil Structures	:	50 Years
Steel Structures	:	50 Years
Buried Earth Electrode System	:	40 Years
Mechanical Equipment	:	20 Years
Electrical Equipment	:	15 Years
Control Panels	:	15 Years
Instrumentation Systems	:	10 Years
Diffusers	:	7 Years
Computer System	:	7 Years

All type of Server and Computer based Software's : Should be updated to latest version of

1.9 Survey and Geotechnical Data

The Employer has the following data available and used these in formulation of the tender elements. They are listed below and shall be used only as guideline. Any use of this report or information contained therein shall be solely at the Contractor's own risk. The Employer accepts no responsibility whatsoever for, nor guarantee, the accuracy, applicability, or completeness of the Report or information contained therein.

- The Employer has got the topographical surveys conducted and also established bench marks along the site. The contour map of Byramanagala STP site is available with BWSSB.
- Geotechnical Investigations Report for Byramanagala STP is available with BWSSB.

Contractor shall carry out the topographical survey, alignment survey, geotechnical investigation and all other details necessary for proper formulation of his price proposal before submission of tender. After award of contract, Contractor shall carry out independently fresh survey, geotechnical investigation, sewage quality analysis and all other details necessary for proper planning, detailed design and execution of all works under this contract. The established bench mark at Byramangala Reservoir shall be verified/confirmed with nearest GTS Bench Mark and shall be used for proposed Byramangala 100 MLD STP. The Contractor will be required to provide full details of the survey and geotechnical investigations for site for approval of the Employer.

1.10 Access for Other Contractors

The Contractor shall allow reasonable access to other Contractors engaged on the Site or on areas adjoining the Site to carry out their works.

In the event of a dispute over access or priority between Contractors, the Engineer shall be informed in writing. The Engineer shall inform all parties concerned in writing of his decision.

Where any part of the Works is associated with or in physical contact with plant supplied under a separate contract, the Contractor shall satisfy himself that the work carried out by the other contractor is consistent with the correct operation of the Plant. In the event of the Contractor considering any work being carried out or any work already completed to be detrimental to the ultimate operation of the Plant, he shall report the matter at once to the Engineer.

If the work of the Contractor is delayed because of any acts or omissions of any other Contractor, the Contractor shall have no claim against the Employer on that account other than for an extension of time.

1.11 Interface with Other Contracts

The Works under this Contract will physically interface with Works under the respective other contracts. The Contractor of this contract shall co-ordinate with Employer and the Contractor of other contracts as applicable and ensure that all interfaces are designed, constructed, installed,

tested, commissioned, operated, and maintained properly to provide a fully functional system meeting all applicable performance requirements.

Available interface information for STP is provided in Volume 2, Section 7, Part 5. However, neither the Employer nor the Engineer make any representation regarding the validity, accuracy, adequacy, or completeness of this information. The Contractor of this contract shall be fully responsible for independently field-verifying any and all information he considers relevant in order to provide a fully functional system.

1.12 Contractor's Bengaluru Site Office

The contractor shall provide general information on the management structure of the design and construction team, and shall make provision for suitably qualified personnel to fill the key positions listed below. The contractor must have qualified employed personnel to fill the following minimum positions. The contractor shall supply information, of the personnel with relevant experience, on a prime experience requirement specified below: candidate and on an alternate for each position; both of whom shall meet the minimum experience requirements specified below: The minimum Design Staff assigned to the Site Office shall be as per Table below and the Office shall include sufficient administrative staff to support the office.

Sl. No.	Position	No. of Position	Minimum Education (Degree Discipline)	Experience (years)		
				Total	In Similar works	As Manager of Similar Works
1	Project/Construction Manager	1	M-ENE / Structures	15	8	5
2	Design Manager	1	M- ENE	15	8	5
3	Asst. Construction Manager- Multidisciplinary works	3	BE - Civil	10	6	2
4	Accident Prevention Officer/ Safety officer	1	B-any discipline PGD -ISM	10	2	N/A
5	Senior Surveyor	1	B-S/CE	5	3	N/A
6	Process Engineer	1	MNE or CHE	10	6	N/A
7	Mechanical Engineer	1	M - Mechanical Engineering / Design	10	2	NA
8	Hydraulic Engineer	1	B-CE	10	3	N/A
9	Structural Engineer	1	M- Structures	10	6	NA
10	Electrical Engineer	1	B-Elec	10	2	NA

Sl. No.	Position	No. of Position	Minimum Education (Degree Discipline)	Experience (years)		
				Total	In Similar works	As Manager of Similar Works
11	Instrumentation Engineer	1	B-IE	10	3	NA
12	Plant Manager O & M	1	B-ENE	10	5	3

NA: Not applicable. Degree: M = Masters; B = Bachelors; PGD= Post Graduate Diploma; ISM= Industrial Safety Management Discipline: E = General Engineering; CE = Civil Engineering; CHE = Chemical Engineering; ME = Mechanical Engineering; EE = Electrical Engineering; ENE = Environmental Engineering; IE = Instrumentation Engineering; S = Surveying; PHE = Public Health Engineering; SE = Sanitary Engineering. The requisite information shall be furnished as per Application Forms.

Contractor shall designate a Design Manager who is responsible for the complete Works design including preparation of Detailed Designs and obtaining all required Detailed Design approvals. The Contractor shall also designate Design Leads for each design discipline required. The Contractor shall mobilize the entire Design Team to Office in Bengaluru. This design team shall work in coordination with Construction team at Site.

The entire design team shall be exclusively drafted to work on this project and shall not be assigned any other project till completion of 100 MLD STP at Byramanagala

The Design team shall be staffed to facilitate and expedite submittals of Detailed Designs. Contractor shall designate Design Manager who reports directly to the Contractor's Project Manager and will be stationed full-time in the Bengaluru Office through the Detailed Design preparation, submittal and approvals. Contractor shall also designate Design Leads for each design discipline required stationed in the Bengaluru Office who will do design production. The Design Manager will communicate directly with Employer's staff and its designees throughout Detailed Design preparation, submittal, review and approval, as well as during the same procedures for submittals for testing and commissioning and all other design related submittal required in accordance with the Contract. The Office Staff in conjunction with the Contractor's Home office staff will be responsible for timely response to Employer's comments related to the Detailed Design.

The Contractor's Project Manager will be responsible for the efficient coordination of the Office, Home Office and Employer's staff & its designees such that the design work proceeds expeditiously.

The Contractor shall operate and maintain its Office throughout the Detailed Design preparation, submittal and approval process. Approval of the Detailed Design shall be determined when all submittals have received a review designation of "A-Approved" and final copies of all Detailed Designs have been submitted. Further contractor shall also submit as built drawings for approval after all designs and drawings are approved in code A.

End of Part 1